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Journal of the Society of Arts.

FRIDAY, JANUARY 14, 1859.

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SWINEY BEQUEST.

A meeting of the judges appointed under the will of the late Dr. Swiney is hereby summoned to be held on Thursday, the 20th of January instant (being the anniversary of his death), when the bequest under the said will, in favour of the "author of the best published Treatise on Jurisprudence," will be adjudged. The meeting will take place at four o'clock, p.m.

(By order) P. LE NEVE FOSTER,
Secretary.

EXHIBITION OF 1861.

The following letter has been addressed to the Members of the Society resident in London:—

Society of Arts, Manufactures, and Commerce, Adelphi, London, W.C., 30th December, 1858.

Sir,—The Council of the Society of Arts, in considering the best means of setting on foot another Exhibition in the year 1861, must request the co-operation of the whole of the gentlemen who, from the very fact of their being members of the Society of Arts, may be considered to have the "Encouragement of Arts, Manufactures, and Commerce" at heart.

1. I am therefore to request that you will be good enough to favour the Council with any observations which your experience may suggest upon the best mode which may be adopted of representing the industry of the metropolis, and particularly of any branch of it in which you may happen to be directly or indirectly interested.

2. They would request you to state, at your earliest convenience, whether any and what improvement you consider could be made on the arrangements of 1851.

3. Whether the conditions sketched out in the resolutions of the Council, published in the 282nd number of the *Journal*, and again in the opening address of the Chairman of the Council, require any modification or extension.

4. Whether you consider that the formation of metropolitan committees would be of use in discussing the preliminary details, and whether there is any particular class of industry upon the committee of which you would prefer to serve. You must be good enough to understand that the functions of such committees must in the first instance be purely deliberative, as the Council are unable to decide how and by what agency the Exhibition will be conducted until they receive from the Commissioners of the Exhibition of 1851 a reply to their application. You may, however, be assured that whatever thought and attention you may be good enough to devote to the subject will be of great advantage to the undertaking.

I am, &c.,
P. LE NEVE FOSTER, Secretary.

The following letter has been addressed to the Members of the Society resident in the country:—

Society of Arts, Manufactures, and Commerce, Adelphi, London, W.C., 30th December, 1858.

Sir,—The Council of the Society of Arts, in considering the best means of setting on foot another Exhibition in 1861, must request the co-operation of the whole of the gentlemen who, from the very fact of their being members of the Society of Arts, may be considered to have the "Encouragement of Arts, Manufactures, and Commerce" at heart.

1. I am therefore directed to request that you will be good enough to favour the Council with any observations which your experience may suggest upon the best mode which may be adopted of representing the industry of your locality in the contemplated Exhibition.

2. They would request you to state, at your earliest convenience, whether any and what improvement you consider could be made on the arrangements of 1851.

3. Whether the conditions sketched out in the resolutions of the Council, published in the 282nd number of the *Journal*, and again in the opening address of the Chairman of the Council, require any modification or extension.

4. Whether you consider that the formation of a committee in your locality would be of use in discussing the preliminary details, and whether you are willing to serve as a member of such committee; and if so, in reference to which of the thirty classes. You must be good enough to understand that the functions of such a committee must in the first instance be purely deliberative, as the Council are unable to decide how and by what precise agency the Exhibition will be conducted until they receive from the Commissioners of the Exhibition of 1851 a reply to their application. You may, however, be assured that whatever thought and attention you may be good enough to devote to the subject will be of great advantage to the undertaking.

Should the formation of a committee be recommended, it might probably be convenient to request the committee of one of the Institutions in Union with the Society to allow the Exhibition Committee to meet in their rooms.

I am, &c.,
P. LE NEVE FOSTER, Secretary.

EXAMINATIONS, 1859.

The following circular has been issued to the Institutions in Union:—

Society for the Encouragement of Arts, Manufactures, and Commerce, Adelphi, London, W.C.,
10th January, 1859.

Dear Sir,—In the Programme of the Examinations for 1859, the Council gave notice that, as the subjects of "Navigation and Nautical Astronomy," "Astronomy," "Botany," "Agriculture," and "Political and Social Economy," were taken up in 1857 and 1858 by fewer than four Candidates, no Paper would be set for the Final Examinations by the Society's Examiners in 1859, in any of those five subjects, unless the Council should be informed, before the 1st of February next, that Ten Candidates are preparing themselves for the Previous Examinations in those subjects.

I am, therefore, directed by the Council to request that, if you know of any Candidates who are preparing themselves for Examination in any one of those five subjects, you will be so good as to write to me, before the 1st of February next, without fail, specifying the number of such Candidates, and the subjects for which they are respectively preparing.

The Society's *Journal* of the 4th of February next will state whether a sufficient number of Candidates has been announced to warrant the setting of Papers in any of the five subjects.

I am, dear Sir, yours faithfully,
P. LE NEVE FOSTER, Secretary.

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following Local Boards of Examiners have been appointed since the last announcement:—

FOR ABERDEEN.

Mr. J. S. Brazier, Lecturer on Agricultural Chemistry, Marischal College.
Dr. Cruickshank, Prof. of Mathematics, Marischal Coll.
Rev. James Fraser, of St. Clement's parish.
Mr. Edward Hennessey, Teacher of Navigation, Regent's Quay.
Mr. David Maver, Teacher, Free Bon-Accord School.
Mr. J. C. Maxwell, Prof. of Natural Philosophy, Marischal College.
Mr. Wm. Rattray, Teacher, Free South Church School.
Mr. James Sinclair, *Secretary.*

FOR ASHFORD (SOUTH-EASTERN RAILWAY MECHANICS' INSTITUTION).

Rev. J. P. Alcock, Vicar of Ashford.
Mr. Jas. Cudworth, Locomotive Superintendent, S.E. Railway, Ashford.
Mr. John Keene, Accountant, S.E. Railway, Ashford.
Mr. Richard C. Mansell, Carriage Superintendent, S.E. Railway, Ashford.
Mr. Francis Garroway, Schoolmaster, 112, New Town, Ashford, *Secretary.*

FOR BANBURY.

Mr. J. H. Beale, Schoolmaster.
Mr. T. A. Hedley, C.E.
Mr. A. B. Rye, M.R.C.S., Banbury.
Rev. Wm. Wilson, Vicar of Banbury.
Mr. Tom Hedley, *Secretary.*

FOR BASINGSTOKE.

Rev. Matthew Harrison, Rural Dean, Church Oakley, Hants.
Mr. Robert Southey Hill, Surgeon, Basingstoke.
Rev. W. B. Lightfoot, Head Master of the Queen's Grammar School, Basingstoke.

FOR BRISTOL.

Rev. Canon Girdlestone, M.A., Royal York-crescent, Clifton, *Chairman.*
Mr. G. C. Ashmead, 1, Alma-vale, Clifton.
Mr. G. H. Bengough, The Ridge, near Bristol.
Rev. J. Bowman, M.A., Principal of Bishop's College, Bristol.
Rev. J. Burder, M.A., South Parade, West Clifton.
Mr. Jas. Carnock, Richmond-hill, Clifton.
Mr. J. A. Cooke (late Mayor), Windsor-terrace, Clifton.
Mr. J. D. Corfe, 31, Richmond-terrace, Clifton.
Earl Ducie, Tortworth Court, Gloucestershire.
Mr. P. H. Edlin, Lennox-villa, Clifton.
Rev. G. Elliott, D.D., Dean of Bristol, Deanery, College-green, Bristol.
Sir A. H. Elton, Bart., Clevedon Court, near Bristol.
Mr. R. E. Ferrier, Fine Arts Academy, Clifton.
Rev. Professor Gotch, Baptist College, Stokes Croft, Bristol.
Mr. F. W. Griffin, Ph.D., Kingsdown-parade, Bristol.
Mr. J. S. Harford, F.S.A., Blaize Castle, Hinbury, near Bristol.
Rev. N. Haycroft, M.A., Portland-square, Bristol.
Mr. M. D. Hill (H.M. Commissioner in Bankruptcy for Bristol District), Heath House, Stapleton, near Bristol.
Mr. C. T. Hudson, M.A., Principal of Grammar School, Bristol.
Mr. W. Kay, M.D., Caledonia-place, Clifton.
Mr. W. H. G. Langton, M.P., Clifton Court, Clifton.
Mr. D. Mackie, M.R.S.A., Queen's-square, Bristol.
Mr. Henry Owgan, LL.D., 7, Albemarle-row, Clifton.
Rev. Jas. Robertson, A.M., 1, Apsley-place, Dendham Down.
Rev. D. Thomas, B.A., Hillside, Cotham, Bristol.
Mr. F. F. Tuckett, Frenchay, near Bristol.
Mr. R. H. Webb, Berkeley-square, Clifton.
Sir J. E. Wilmot, Bart. (Judge of County Court), Bristol.
Rev. J. R. Wreford, D.D., St. Michael's-hill, Bristol.
Mr. J. F. R. Daniel, Athenæum, Bristol, *Secretary.*

FOR WIGAN.

Mr. Joseph Ingram, Freckleton, Wigan, *Chairman.*
Mr. Jos. Acton, Wigan.
Mr. Baines, Marsden-square, Wigan.
Mr. W. A. Barrow, solicitor, Wigan.
Rev. D. Blyth, Wigan.
Mr. J. T. Fitzadam, barrister, Wigan.
Mr. Wm. Holt, book-keeper, Poolstock, Wigan.
Mr. Marsden, book-keeper, Marsden-square, Wigan.
Mr. James Mitchell, District Bank, Wigan.
Mr. Maskell Pease, solicitor, Wigan.
Mr. R. Smith, Mechanics' Institution, Wigan.
Rev. W. T. Whitehead, Ince Parsonage, Wigan.
Mr. Thos. F. Fergie, *Hon. Secretary.*

FOR WINDSOR.

Rev. W. C. Bromehead, 10, York-place, Windsor.
Mr. Thos. Chamberlain, Thames-street, Windsor.
Mr. Joseph Lundy, Victoria-street, Windsor.
Mr. Frederick Twinch, Peascod-street, Windsor.
Mr. Alfred Williams, National Schools, Windsor.
Mr. Chas. T. Phillips, Sheet-street, Windsor, *Hon. Sec.*

This Board is willing to conduct the Examination of Candidates from Institutions within a radius of ten miles from Windsor.

ON THE CULTURE OF FOOD.

By W. BRIDGES ADAMS.

Other things being equal, the happiest people are they who possess the most abundant supply of the most wholesome food from the land which surrounds them, so as to insure against scarcity. This condition supposes a surplus of food, and not a merely exact supply. Abundance, to permit of some waste, is essential; and though the axiom "Waste not, want not," be a sound one, there are numerous contingencies which make it desirable to waste some surplus of human labour on a surplus of food to throw away, rather than to calculate too closely, without margin. It is true "that increase of appetite doth grow by what it feeds on," if the table for one hundred be supplied with food for ninety and nine, while the contrary will be the case if the food be sufficient for a hundred and one. We have the apparent anomaly of constant waste and destruction of food in the processes of imperfect distribution, while there is a fringe of starving people constantly existing on the edges of society; but the true remedy for it is not by putting everyone into a condition of anxious calculation of quantities; the true plan is to ensure a larger surplus.

Malthus tells us that there is a constant pressure of population against the means of subsistence, which is only saying, in other words, that pleasures are instinctive, while work is a result of moral and physical economy. As moral training improves, the pressure will become less by the multiplication of food, and the lessening of the drudgery of procuring it. Wherever life prevails, either in animals or vegetables, nature has provided for an enormous surplus of births, to compensate for destruction. The mustard plant would cover the whole earth, were there no animals to devour it, no competitive plant to disturb it. Thus the weakest perish under nature's law, being destroyed by the strongest, and thus the strongest and hardiest, both of plants and animals, are kept up to perpetuate the species.

Wherever unintelligent uncultivated man prowls, he follows this law in common with the lower animals. Red Indians, in tribes, finding food scarce by the too great destruction of wild animals, massacre each other, the strongest prevailing, and by the lessening of their numbers, the deer and bisons again increase. This is the condition of the universal law of prey, under which lions and tigers live—spontaneous food.

Intelligent, cultivated man no less obeys the law of nature, but in a different mode. By artificial increase in the quantity of food, he prevents competition, and abrogates the law of prey. The surface of the earth is practically multiplied by human skill in proportion as the human understanding is cultivated, and the time will doubtless arrive when contingencies of all kinds will be provided against.

During years of travel, my attention was much awakened to the results on humanity of various kinds of food, and the modes of procuring it. We all know what Ireland has been like, with its one universal diet of potatoes, and the emigration consequent on their failure, as well as the perennial starvation, and self-imposed poor law under the name of hospitality. Amongst the French *habitans* of Canada, a similar condition of things prevailed, possibly prevails still, though not confined to potatoes. The cultivators of the soil, living apart from markets, produced in the summer provisions to store up for the winter. If their calculations were incorrect, starvation occasionally overtook whole families, who died before the return of the crop season. Vegetable-fed, gentle, and suffering patiently, they passed away.

On the Pampas of Buenos Ayres, a lank, lithe, wire-haired, dark-looking, black-eyed race of men ride constantly on horseback, and feed on the flesh of animals of various kinds, but chiefly beef, which is roasted with the hot blood in it by fires of dried dung. If allowed to get cold, it becomes tough. Horses, mules, and deer have a sweet flavour when eaten fresh; and as there is no provision of safes to keep meat from flies and vermin, beef is preferred as the best flavoured in its fresh condition, albeit stringy. Of this food a man will devour at a squatting four or more pounds, without salt or vegetable. Grass being abundant and men scarce, the cattle increase and multiply to an enormous extent, as there are scarcely any wild animals to prey on them other than wild men. But at intervals of from four to five years, there occurs a drought, the grass disappears, and the neighbourhood of the dried-up streams becomes a cattle Golgotha, and the land is thus largely manured for the advent of the ensuing rain. Nature deals in compensations.

In Chilé meat is a luxury of the wealthy, and those who labour feed on dried beans and bread when they can get it. Small tenants, or farmers, renting pieces of land—for Chilé is owned by a landocracy—store up their scanty crops, potatoes, pumpkins, beans, red pepper, and onions, for winter use, with wheat if they can, though it is generally sold on the ground to those who are in the blessed condition of possessing granaries, after the due deduction for those who lend the oxen to plough the soil. In years long past, one shilling per bushel was the value for wheat on the ground before reaping, rising to two shillings after reaping, and four shillings in the mid-interval between season and season. One particular year, known as the year of the flood, on account of heavy rain at intervals, the crops, usually grown by means of irrigation, failed by blight, and the price rose to six shillings. The poor people, and perhaps the rich also, unaccustomed to this, sold all their best wheat, and saved the worst for seed. The result was that in the following year, the price rose to twenty shillings, and in the garden of the Pacific, that was wont to supply all Peru with breadstuffs, large numbers of people were reduced to live on wild herbage and seaweed, many of them perishing. And then, for the first time, barrelled flour was received round Cape Horn from the United States, to feed a nation following the occupation of food producers.

In Chilé people pray for snow, and not for rain. If the deep clefts of the Cordilleras be stored with snow in the June winter, they are sure of full rivers in the summer, and, by means of irrigation, they have full crops. Even sand is made to produce when water can be made to reach it. The lowest level valleys are the choice lands—*tierras di riego*—but the mountain hill slopes, bathed by the moist winds of the Pacific, are also fruitful. Bountiful, also, are some of the slopes and plains on the eastern side of the Andes, where irrigation is brought to bear, as the corn, wine, and oil of Mendoza and San Juan can testify, but the hot Sonda wind, the American simoom, and the plague of locusts are there to defeat man's work, and cover the emerald oasis with the barest brown. "What bird is this?" I asked of my guide, when the first locust struck me, a stranger, in the face. "A bird of bad omen, Senor!" was his reply, in a strain of oriental diction, "the leader of those birds who will leave us no bread to eat," and so it was. They came on and on, a hideous brown cloud, shading the sun, with horn-sheathed eyes and cutting forceps, that left the trees leafless and the ground bare.

In that dry land were two methods of making granaries. One was to dig a hole in the soil, under cut-line it with stones, fill it with wheat, and cover it up, thus converting one-third into a fermented and caking crust that held the remainder in good preservation. Another method was to take off the skin of an ox entire, extracting carcase and bones through the orifice of the neck, then hanging it between four posts and filling it with earth till the hide, very distended, expanded to twice its former size, and then dried to the condition of thick parchment, when the earth was taken out and replaced by wheat. A row of these bloated skins, standing side by side in order, with the horns suspended just above the ground, presented a strong resemblance to a file of Assyrian stone bulls, headless by age.

On the heights of Potosi, where the far-famed conical silver mountain is pierced on all sides like a honeycomb, there is no soil to grow vegetation, and upon troops of mules and flocks of llamas the food of 80,000 human beings is brought into the mud-built city. Rich soil is conveyed in pots to the interior of the dwellings, and green herbs of savour are grown, that a sprig from time to time may be used to flavour the broth. There, also, the art of economising fuel prevails, by burning it in a horizontal flue, pierced in the upper surface with round holes, into which are fitted the earthen cooking utensils.

Maize, meal, potatoes, and animal fat, are concocted into many kinds of edibles, and old women in a circle chew maize grains to a fermentable condition to manu- or, rather, mouth-facture maize wort into an execrable beer.

"In the sweat of thy brow shalt thou eat bread," is well verified on the spots from which the grain is brought. I have seen a team at work in which a cow was tied to the plough—a veritable old Roman implement—a mule to the cow and an ass to the mule, and a woman, with the leading cord over her shoulder, adding her physical strength to the whole, while her husband held the single stilt. And I have seen a score of women spinning cotton at the edge of a mountain lake, each with her wheel driven by a spirt of water to spin a single thread, the principle of the cotton mill and spinning jenny not developed; and I have seen Patagonian women, with a loom formed of pegs stuck in the bare earth open to the sky, on their knees plying the shuttle to form a poncho of the brightest of wool, dyed and spun by themselves, and capable of turning any amount of rain water better than the best woof of Leeds or Manchester; and I have seen the Chilé gold crushing mills at work, made of native wood and native granite, with not five pounds weight of iron in their whole composition, extracting gold more effectually than by all the powers hitherto used by more civilised people.

Frequent hunger, sometimes very like starvation, stirred deep thought in me on the question of food-producing and food-preserving. The difference between gardening and field culture in result was obvious, but that whole difference was produced by human labour. I remarked a very great difference between land cultivated by irrigation, both in labour and produce, saving the one and increasing the other. Irrigation drew too much fertility out of the upper soil into the lower. The sun also was a main element. I know by experience the difference in nutritious effect produced by the flesh of tired cattle on a march, and those slain in a condition arising from abundant food and healthy exercise. In the former case any amount might be eaten without the satisfaction of hunger, while, in the latter case, a smaller amount removed hunger. But I discovered, also, that certain other food of a different quality, such as grape syrup and fruit could help the tired meat to assimilate, and thus to remove hunger. But not till long after, when I had read Liebig's remarkable experiments, did I know the chemical reasons. Travelling is not favourable to chemical research. I knew that heat and water were essentials in growth, but how they operated I knew not.

When first I saw the steam coach of Walter Hancock traversing the New-road, my mind went beyond the mere vehicle of transit. I saw the power that moved the cotton and silk mill made locomotive, and I beheld the elements of agricultural labour thereon transferred from man to steam. The how was in the future.

It appeared to me, as it does now, that one of the first principles in producing vegetable food should be to change their structure as we do that of animals, to get rid as much as possible of the mere water, and replace it with oily and nitrogenous substance. When gardeners shall have bestowed as much pains on the conversion of food vegetables as they have done on flowers and fruits, we shall probably attain to more startling results.

Our vegetable root and seed crops grow in the summer and cease to grow in the winter. The difference obviously exists in the presence or absence of the sun, for unexpected sun in winter causes the buds to put forth; artificial heat in hothouses or greenhouses does the same thing; and, in parts of Saxony, where coal mines are on fire a considerable depth underground, the snow never lies, and the grass is green the whole year round. If we could have the coal-pits alight underground in England we should soon turn them to account in the growth of better things than grass, and carry off the produce by railway.

The truth is that plants, like human beings, like to have their feet warm and their heads cool. Gardeners will tell us long stories about "bottom heat" in greenhouses, but they never think about it in the open air. Vines and other deep-rooted plants will push out their roots in search of steam pipes or other underground heat for long distances, just as fish will congregate in the neighbourhood of tepid water where food is found. It is probable that the stimulus of ammonia to plants is analogous to that of heat, but the ammonia and other kinds of manure exhibited on the surface of the ground seem to be very wastefully dealt with. They ascend into the atmosphere instead of descending into the soil.

We require, then, to deposit both heat and manure under the soil, where the roots of the plants may find and appropriate them, instead of upon the soil where they escape. By the combustion of coal we get both heat and ammonia, and there seems to be no reason why we should not distribute the products of combustion underground in such chemical arrangement as to prevent mischief and attain useful results. The refuse of the gas works is gradually converting into manure. Why should we not put it underground direct, and—plus the heat so useful in cultivation. Why not put heat underground in the form of steam or hot water, combined with charcoal manure. The heat deposited could not be wasted. It could only escape by ascending to the surface, and thus warming the whole soil. The liquid manure, spread on the surface, is wasteful to begin with, and has also the effect of making the surface into a solid plaster, impeding the action of the atmosphere.

Supposing this to be capable of mechanical accomplishment, the question will be "Will it pay?"

No; it will not pay if it be done in a remote corner without means of efficient transit, but if it be produced within easy distances of large towns, with a cheap railway running direct from the crops to the market, there can be no doubt of its paying a higher profit then has ever yet been achieved upon land. The growth of root crops and leaf crops, though not of seed crops, can be prolonged for a far greater period throughout the year, into the months when the sun does not shine; and the consumption is almost unlimited. As yet green vegetables have been, for the most part, a luxury confined to the rich and easy classes. Every class would consume them in large quantities could they only get them within reach of their means. A cheap railway, with a growing ground at one end and the actual city market at the other, are the simple means.

All things considered, the heaviest crops are produced upon lands where rain rarely falls, but where an abundant supply of water exists for the purpose of artificial irrigation. Certain plants grow best in swamps according to our present practice, but it does not follow that they would not grow better with a plentiful supply of running instead of stagnant water. In Great Britain for years past a chief object in agriculture has been to drain the land, *i.e.*, to clear away all the natural reservoirs for water, reservoirs provided by nature during man's mental minority. Our climate is thus bettered and bettering, and the time will come when this constant drainage will leave the land too dry, and we shall have to resort to artificial reservoirs to retain in larger bodies the water which now reaches the sea in but a few hours after a rainfall, and to use that water for irrigation purposes in better modes than are practised in the hot lands of the tropics, and in our own "water meadows." The practice of irrigation in the East can scarcely be called artificial, inasmuch as the water is merely let at intervals down natural slopes of the earth's surface. Pure artificial irrigation would be to convey water and manure not on to the surface, but beneath the surface of either level or sloping land without artificial channels on the surface, and without converting the soil into a crust.

The first conditions, then, of the artificial culture of vegetables are,—facility of removing surplus moisture from the soil; facility of artificially heating the soil by bottom heat; facility of giving bottom moisture to the soil; facility of giving bottom manure to the soil.

These conditions are recognised in hothouses and greenhouses with patches of a few yards of earth, but with the disadvantages of imperfect aeration of the leaves of the plants, and consequently a comparatively unhealthy crop. With bottom heat below the ground cold and damp would be tempered to a sufficient height above the ground, and any amount of acreage could be brought into a condition of continuous crops.

Drainage for the discharge of surplus water from land is well understood, but the application of the same pipes for the irrigation of land does not seem to be understood at all. The cheapest source of heat that we at present know of is coal. To burn coal in a close furnace, and to discharge the products of combustion into a congeries of pipes four feet beneath the soil, does not seem a problem of difficult solution. If draught be difficult, a fan or blower at the exit would ensure the circulation. Whether the simple products of combustion would be noxious or not to the plants after filtering through the earth, must be a matter of experiment. If they proved noxious, it would be for the chemist to make a neutralising admixture. Whether the injection of steam with gaseous manure combined would be better, remains also a matter for experiment. One thing is certain, that the greater part of product refuse of the gas works is convertible into manure, and that its cost is enhanced by double transit. With the coal carried direct on to the farm, and the distribution of the heat and gaseous manure without any cost of men or animals, the economy ought to be very great indeed.

Meanwhile the experiments for crossing and feeding vegetables, as we now cross and feed animals, and as we cross and feed flowers, should be made the subject of deep and wide experimental research. No cheapening of labour is essential for this object.

I now come to consider the great, the paramount question of all—how to extinguish animal labour and reduce the physical drudgery of farm labourers to the healthy exercise of intelligent and cultivated men. Upon the thorough solution of this question depends the extinction of slavery, whether black or white, throughout the world. Issachar shall no longer be a strong ass between two burthens. Coolies or Chinese shall no longer be hired out as farm cattle, nor shall the African be longer kidnapped and sold for a working ox, with his life shortened by excessive work in the service of those political economists in cotton and sugar who deem that it is better to buy than breed.

Connected with railways for a long period, one of my principles was that the hard iron surface, which diminished friction and economised labour in transit, must be still more suitable in the process of working the land, where both transit and labour were requisite. In the year 1845 I wrote an article in the *Westminster Review*, propounding the theory of rails on cultivated land for the purpose of supplying steam power, then supposing stationary power:—

> "In farm districts the power need only be applied to road purposes when required, using it for farm purposes at all other times.
>
> "In sober earnestness we propose to convey artificial heat beneath the earth on open land, so as to maintain the temperature suited to the growth and development of the vegetable tribes by means of pipes of metal or earthenware circulating steam or hot water or air from a close boiler or stove. These pipes to be laid at depths of four to five feet in the manner of deep draining. Also by a similar process to inject the ground with gaseous manure, as ammonia and carbon, so that the heat and gases may be constantly ascending towards the surface, and thus be absorbed by the roots of the plants.
>
> "We shall yet see the time when rails will be laid along the surfaces of our fields, whereon cylinder harrows will traverse, driven by the same stationary power, to break the soil into fragments fit for the growth of plants.
>
> "When our land shall be drained, dried, moistened, heated, cooled, and injected with liquid and gaseous manures at pleasure, and, moreover, cultivated by power machines, we may be truly said to have conquered the earth, or a portion of it."

Nothing practical that I am aware of came of this, though sundry "improvers" and projectors pronounced the idea "ingenious." Still, the ideas of heat and manure *injection*, in opposition to surface applications and the application of rails and steam-power, remained in my mind a conviction, though not demonstrated publicly, to which I recurred from time to time in publications, other pursuits rendering it difficult for me to aim at practice. Early in 1850 I published a work called "Road Progress," advocating the amalgamation of railways and highways for agricultural improvement and steam farming in Great Britain and the Colonies. The following is an extract:—

> "From the towns the parish roads diverge, and rails laid on them might be carried direct into the farmyard. Here, then, we have the produce at one end of the line, and the metropolis or other town at the other end. . . . . From this farmyard lines of moveable rails would be found well adapted to take the dunging and manure by horse-trucks to the centre of each field; or a farm locomotive might be established thereon, a proposition not for ploughing, but for doing the same kind of work better by harrowing, or it might be used to pump water up to drain away, or to pour over the fields in irrigation, or to inject manure or heat, or both combined, beneath the surface of the land for the sake of improved produce. With a small portable saw-bench and morticing machine, ready to connect to the engine, the farmer might, with the rude skill of his own farm-labourers construct from time to time all the wood work he might require, as is the common practice amongst farmers in the United States.
>
> "It is difficult to estimate the importance of carrying coals by rails direct into the farm. From that time the farm will take rank with the factory in labour-saving processes, and the production of food will be so cheapened as to put to rest for ever the fear of foreign competition. Without cheap coal, farm operations can but be very imperfect."

My next attempt at agitating this question of railways into farms with steam culture was, if I recollect, in a paper read before the Society of Arts in December, 1850.

> "Siding rails would run into farm-yards, and the markets would be at the stations and termini. Coals being thus borne cheaply on to the farm, farm machinery would rapidly increase, and farm labourers would acquire mechanical skill. Temporary rails would become a farm utensil, as they now are in the hands of road contractors, and contrivances innumerable would be the result. * * And not mere grain and meat would be produced on the farms, but the heavy class of vegetables, so important as human food, but which hitherto no town has possessed up to the extent of its consuming power. * * The power of the locomotive might also be applied to inject land with steam heat and gaseous manure through the system of drain-pipes.
>
> "There is yet needing an influential landholder to be the agricultural railway-maker—what a Bridgewater was to the canal-maker, and a Devonshire has been to the horticulturist—to multiply manifold his own revenue, while being the world's benefactor."

In 1851, in an article in the *Westminster Review*, on the Industrial Exhibition, I again agitated the question:—

> "Unless the rails so laid on occupation roads shall have one terminus in the farm-yard and the other in the market, either directly or in communication with main lines of railway, the maximum of cheap transit for produce will not be attained. When this shall be done, and it will probably be by the agency of rails inserted in the surface of ordinary highways, the costly and artificial labour of the farmer in shifting his loads will cease, and the saving will become perfect.
>
> "But there is more than this, to which we have called public attention before. There needs a system of rails for transit on the farms. Time will show that permanent ways, as well as moveable, will be needed; but permanent way means a new laying-out of the farms in rectangles, to which the system of steam-digging may be applied—not steam-ploughing, for ploughing is a process that never would have been invented had not horses and oxen been invented first. We do not plough with man-power, neither can we with steam-power to advantage."

After the Great Exhibition I was not one amongst those disposed to scoff at the "agricultural mind." Considering their isolation from the hands of thickly congregated men in cities, the wonder really was how much the farmers had accomplished, and not how little. Considering that working farmers possessed but small capital, and mostly short leases and no freeholds, it was not wonderful that they did not dream of bringing the machinery of a cotton mill on to the land, and those who possessed the capital, the landlords, had little belief in steam. Lord Willoughby D'Eresby did try to turn a locomotive to account by a system of ropes, but this was a failure, and most plans since have had reference to drawing ploughs by ropes. The practicability of using an engine bearing on the soil to dig by steam power and propel itself has been much mooted, but till the advent of Boydell's engine it was an impracticability, and of questionable advantage even with that. My own view of the process of earth working was thus expressed in the article on the International Exhibition:—

> "For heavy land there needs a revolving engine, made to cut with the sides, with an advancing movement, precisely as grooves are cut by machinery in wood. When there is hard work to do, circular movement is the only method, whether for wood-carving, metal-turning, timber-sawing, or earth-cutting,

and we are not sure that a series of vertical drills on a large scale, of the size of spades, cutting the whole surface to a sufficient depth, and travelling forwards at the same time, would not be the most efficient mode of ploughing. We incline to think that the time will come when ploughing and drilling, sowing and harrowing, will all be performed at a single operation, like paper-making. It is but getting together a mass of earth spinning-jennies, of stronger construction than those used for cotton and flax. The only impediment is too much moisture, but this may always be avoided by sufficient drainage. * * We apprehend that it will be in the North—in Lancashire and Yorkshire—that the first strides will be made towards obtaining the real possession of the earth for the purposes of agriculture."

Thoroughly convinced of the practicability of such a system of cultivation by steam machinery combined with rails, I had purposed, amongst other projects, to give my imaginations practical effect, or rather to combine existing practice into a whole, whenever leisure might obtain. It was, therefore, with no small pleasure that I listened to the paper read by Mr. P. A. Halkett before the Society of Arts, on the 8th of December last, on "Guideway Agriculture, being a system enabling all the operations of the farm to be performed by steam power." It was not left for Lancashire or Yorkshire to do this thing, but to Peter Alexander Halkett, of the Windham Club, St. James's, in our own London, and I understand a naval officer to boot, and not an agriculturist, showing that now, as often before, improvements come from outsiders looking on, rather than from regular practitioners.

To any competent mechanic the diagrams would have sufficed without the paper, but on the following day I visited Mr. Halkett's machinery at Kensington, and found in Mr. Grafton a most intelligent and practical exponent of the whole system, which in general terms amounts to this:—

The travelling platform frame of the builder, such as we see at the Houses of Parliament and Westminster Bridge, and at Portland and Holyhead, moving by man power on rails, on the tops of high scaffolds, is enlarged in width and breadth, and placed on rails on the surface of the land to be cultivated, raised to such a height as to clear the plants, and instead of man power is moved by engine power, which also serves to put in operation the various tools required for dealing with the land. The tramway frame of the builder is thus practically married to the portable engine of the farmer, and is furnished with tools from the workshop of the engineer. The mill that cuts iron like cheese has ceased to be a fixture, and is made moveable over the face of the land, to cut and carve the soil into fragments, to rake it into fine mould, to free it from weeds, and clean it from stones if needed. This, at Kensington, is the practical germ of the process that will multiply four-fold the farmer's crops, that will convert the farm labourer from an ill-clad uncultivated human being, into a well-clad intelligent mechanic, working under covered shelter from the sun and rain, and with all the advantages of fresh air for his workshop, that will enable this intelligent mechanic to work on a sugar or cotton plantation with a steam fan if needed, keeping his body constantly cool; that will give to the white man the practical dominion over tropical labour he thinks now only attainable by the negro; that will make as great a revolution for humanity as was done by the advent of railroads, which destroyed the practice of cruelty in overdriving post-horses; that will render the night equally available with the day for all the processes of cultivation. The plough, the harrow, and the hoe, the rake, and the dibble, broad-cast, and drill sowing, may all be set in motion by steam, and hoeing between rows of wheat may at last be accomplished.

For the purpose of depositing liquid manure at the roots of the plants instead of on the surface, Mr. Halkett has constructed a tool in imitation of the tooth of the poisonous serpent or the sting of the wasp. The liquid exudes through the end of the pipe which cuts the trench below the surface. But there is yet a very important tool that requires adding, a vertical drill with cutting edges, which, as it advances, will comminute and aerate the soil between rows of plants, and produce a far better result than the man hoe.

The tank carried on the platform will be very available for liquid manure, but for the purposes of general irrigation a new method is desirable, as it would be impossible to carry sufficient water on wheels. Perforated pipes of earthenware should be deposited at two feet depth below the surface, provided with entrance for the water but no exit. These pipes being filled from the nearest level, the water will be absorbed by the spongy superincumbent soil, and carried to the plants without caking the surface. This is a most important process, for it will render level uplands more valuable than the low-lying lands called meadows, usually selected for market gardens, as Greenwich and Deptford.

An arrangement of this kind would be peculiarly adapted for hot climates, were it only to save water. The valley of Valencia, in Spain, is a large triangular plain, sloping to the Mediterranean, between two lofty mountain ranges, which unite where the river rushes down. This river, the Guadalquiver, would be, in the warm season, wholly absorbed for the purposes of useful irrigation, but, probably, one-third of it is evaporated by the sun, and another third wasted on surface weeds, and the scarcity of water is so great that perennially faction fights occur amongst the peasantry quarrelling for water, which have to be put down by the soldiery, and though scarcely a drop reaches the sea, large quantities of fine land lie waste.

On this system of cultivation by machinery it is obvious that a straight surface of soil is the best, and that a level surface will involve less power than an incline. It is obvious, also, that the longer the run of the machine the more convenient will be the operation and the less the cost of rails, as there will be less proportional amount of heading, and, doubtless, as the system goes on, levelling of the soil will take place, as on roads, to facilitate draught. Other things being equal, the level surface will be worked at less cost than the incline, as is the case when horses are used.

I now come to the question of the rails and machinery as set out by Mr. Halkett.

To work a railway economically with the least consumption of fuel, it is essential that the rails should not deflect either vertically or horizontally. The greater the pressure the stiffer the rail must be, and the shorter the length over which that pressure extends the greater must be the strength of the rail. If traction be performed by the adhesion of driving wheels, the greater the number of driving wheels with a given load the more the pressure will be distributed, and the lighter may be the rail. As the cost of the rail is proportionately greater than that of the machine, Mr. Halkett prefers to use light rails and a large number of driving wheels.

On an ordinary line of railway the wheels have a single flange in the inside, and the peripheries are in the form of cones and not of cylinders. The object of this is to compensate for curves on the rails. The result is a great pressure, tending to force the rails out and widen the gauge. For this reason strong cross ties are essential to hold the rails together. For the purpose of cultivation these cross ties are inadmissible, and therefore the wheels of the machine must be made cylindrical and with two flanges. In this mode there will be no tendency to vary the width of the gauge.

In using a single pair of driving wheels for the purpose of propelling in a straight line, there should be no rubbing friction, provided the wheels are exactly of the same diameter. And whatever is the number of the driving wheels, the exactness must exist both in the peripheries and in the crank pins and connecting rods, or in the connecting chains if chains be used. It becomes, therefore, a question between stiff rails and few drivers, or light rails and many drivers, as to cost. If cast wheels be used not turned to exactness in the lathe, some compensation must be provided to prevent the rubbing of the tyres on the rails, which would soon destroy both. Mr. Halkett, dealing at present with very flexible rails, which can securely be permanent, does not sufficiently estimate the amount of this difficulty which will occur when solid machines and sufficiently firm rails are used. Moreover, if stiffness be not provided in the rails, it must be in the frame. A flexible frame would not distribute the load, but would suffer every wheel to sink into the successive hollows.

The rail Mr. Halkett has chosen—a light angle-iron, is the worst form for strength that can be contrived, unless we suppose it to be firmly fastened down to a solid base. I have used such rails for light purposes in machinery, but it is a serious objection that they deflect vertically and widen laterally, decreasing their vertical strength rapidly as their load increases. If with a given weight of metal Mr. Halkett does not find his rail deflect, it will simply prove that he is using iron in waste.

The system is made to depend, not on the strength of the rail itself, but on a substructure of burnt clay or concrete 15 inches wide. The cost is stated at £20 per acre, leaving a serious nuisance on the ground, if at any time the course of the rails need to be changed. There is no need whatever for this substructure, for at the same cost a self-contained rail of great strength can be applied on the surface in such a mode that it can be taken away without any waste and removed to another position when required. If a rail be used so weak as to depend on substructure, there will need a constant patching and mending. If a stiff rail be used, the ordinary surface will be sufficient.

The frame, pair of engines and tools, are estimated to weigh about 24 tons, on twenty-four wheels, or a ton per wheel. As this weight is all adhesive or propelling, it will be equivalent to six tons of traction force, supposing no undue friction. If cylinders of 6 inches diameter be used with a 4 feet wheel and sixteen inches stroke of piston, the locomotives will give out about 2,500 lbs. at the periphery of the wheel, and as little more than 250 lbs. will be needed for the purpose of propulsion at 13 lbs. per ton, 2,250 lbs. will be left to work the machinery at a speed of 10 miles per hour.

But if instead of a level there be an incline of one in 100, the resistance to traction will absorb about 740 lbs.; on an incline of one in 25, about 2312 lbs., nearly the whole force.

If the driving-wheels be worked at a slower speed, with a toothed pinion at the periphery, there will of course be more available power for the machinery.

The system of Mr. Halkett, in making a double engine for an enormously wide gauge by a connecting beam, thus keeping the chief load direct on the rails, displays great ingenuity, but whether the multiplicity of driving wheels in connection with it for the sake of a light rail, will prove the best system remains yet to be seen, and it would be quite worth while to try the plan of Mr. Boydell with a similar structure.

There is little doubt that a gauge of 60 feet may be worked on this system, which will only require 250 yards of rail per acre including headings, calculating a farm of a square mile, or 640 acres, at a cost of £20 per acre, or £12,800 per mile. The machine may be estimated at £2,000, making a total of £14,800, which for interest and materials will be £3 annual per acre. But the machine will go over the whole mile in 44 hours, say three times in a week, so that four square miles may be estimated to one machine. Reflecting that the rails of four square miles, or 2,560 acres, only weigh 5,000 tons, and the machine 25 tons—total weight 5,025 tons, and total cost £53,200, and total annual interest and material £6,384, it does not seem a matter beyond the reach of a company of tenant farmers with a moderately long lease, inasmuch as they can carry off the whole of the materials at the end of the lease, and the more especially with the probability of a double crop off the same extent of ground at half the cost of labour.

If this manifestly practical plan, doubling the strength and power of the English nation, be suffered to lie in abeyance, it will be a standing satire upon the agricultural bodies ranking amongst them the oldest traditional names of our country.

NEW PAPER MATERIALS.

By M. C. Cooke.

One result may fairly be attributed to the offer of a premium, by one of the daily papers, for a new and available paper-stuff, which should supply the deficiency of rags; and that result an important one. It has stimulated many an effort to supply that want not only at home but abroad; and we are now in a much better position to do without rags for our own paper manufacture than at any other period of our history. It may be true that the premium has never been paid, but it is equally true that we are nationally full the thousand pounds richer on account of that offer. Why it has not been paid, forms no part of this inquiry, neither to whom it should have been awarded. Let it suffice to point to some of its results. Out of the numerous efforts to furnish good paper with only a per centage of rags, one of the most successful with which I am acquainted is that of Dr. Collyer, which was patented in 1857. It consists in applying the residue of the beet-root left in the process of sugar making and distillation to the manufacture of paper, papier maché, millboard, and other paper manufactures. One feature pointed out in the process of this manufacture is, that no sizing is necessary, on account of the nature of the material used. In consequence of the whole mass being permeated, instead of the surface alone being covered, it is, from its compactness, solidity, and elasticity, not liable to crack, and for the same reason will resist damp and moisture when in the form of paper. The patentee states, "The extraordinary tendency which the cellulose, starchy, and proteine substances have to enlarge when exposed to heat and moisture, renders them very valuable for giving strength to other material, especially to cotton, which is deficient in these properties. When thus mixed each fibre of the cotton becomes cylindrical and thick, and attains the strength of hemp and flax, and no longer loses its shape through pressure. A similar improvement is evident when it is combined with other materials. A proportion of 10 per cent. of the prepared residue with the other usual material, makes tougher and more flexible paper. Twenty-five per cent. renders packing paper sufficiently waterproof that it will require no other sizing. Fifty per cent. will produce paper nearly or quite as strong as parchment, and which in very thin sheets will preserve articles packed in it from dampness. Strong paper, cardboard, &c., can be made from 75 per cent. of prepared residue and 25 per cent. of cotton; also of 50 per cent. of prepared residue 40 per cent. of raw residue, and 10 per cent. of sawdust, hay, straw, &c. Fifty per cent. of prepared residue and 50 per cent. of fine cut straw will produce strong packing paper, as will also 50 per cent. of white sawdust, 30 per cent. of prepared residue, and 20 per cent. of cotton rags. A good, strong, white paper for printing purposes has been made with 50 per cent. of beet-root residue and 50 per cent. of cotton, no sizing being required in the process, and the result has been entirely satisfactory, the paper so made being remarkable for its tenacity. It will, however, have been observed that something beside the beet-root residue is required to make good paper, and that the best substance for that addition is cotton or cotton rags, the use of which this patent does not supersede."

Another patent, or rather series of patented paper pulps, worthy of notice, are those of Mr. Plunkett, of Dublin,[*] in all of which the material, *per se*, is capable of furnishing serviceable paper. Patented also in 1857, the entire value and capabilities of the materials have not yet been fully ascertained. Mr. Plunkett's papers are made from four different plants, any one of which furnishes a good paper pulp, and may be obtained in almost unlimited quantities. These are the tree mallow, red clover, hop bine, and yellow water-iris. To the first of these we may look, perhaps, for the most satisfactory results. The order to which the tree-mallow belongs is composed of eminently fibre-producing plants. Independent of the cottons, we have numerous species of *Hibiscus*, *Sida*, *Abutilon*, *Urena*, and *Thespesia*, yielding useful fibres, which leads us to expect, perhaps, to find in *Lavatera arborea* a good material for pulp.

"The tree-mallow grows wild on several parts of the south-west coast of Britain, as well as on the east coast of Scotland, on rocky cliffs, flowering in July, and often producing a long succession of bloom. In gardens the plant often remains some years without blossoming, but dies in the winter after it has flowered, being naturally biennial. Seeds scattered in the ground will some of them keep springing up every season for an undetermined number of years, but the young plants are impatient of the cold, except in maritime situations, and few of them survive even a single winter. The root is deep and much branched; stem, 6 to 10 feet high, upright, straight, round, simple, except in the upper part, where it forms a branched leafy head. It is clothed with clusters of small deflexed bristles. Leaves alternate on long stalks, pliable and downy, of seven shallow crenate lobes. Flower on simple axillary clustered stalks, very much like those of *Malva sylvestris*. Outer calyx deeply divided into three large lobes, but not as in Malva formed of three separate leaves. A slight or rather artificial distinction."[†]

On inquiry, I find that the *Lavatera* will, with the addition of saline manure, grow freely on the deepest bog land. My informant states that he has seen it in perfection on the west coast of Donegal, growing where there was very deep bog, at least thirty feet. A gentleman in Londonderry, who is owner of a large tract of slob land, intends cultivating the plant extensively next season, for which purpose he has about 250 acres at disposal. When this experiment shall have been made, we shall be in possession of facts as to the cost of culture and the produce per acre. The plant, if cultivated, would not only yield hemp enough for home use, but also give, from the hacklings, or tow, and the wood, a large supply of paper material. The quality of the hemp obtained from the bark would command for it a ready sale. Cordage has been made from it experimentally, and so satisfied were the company entrusted with the manufacture of the specimens, that they have guaranteed the purchase of any quantity which may be grown on the Londonderry estate next season. The refuse leaves, wood, and tow, would furnish paper pulp.

The process of manufacture of paper from these substances is that ordinarily pursued. The wood has to be reduced to chips or shavings, and, whether wood, leaves, or tow, boiled in caustic alkali, and bleached in the ordinary manner. The paper thus made presents no external variation from that made of rags.

Specimens of the plant, wood, hemp, cordage, fine thread, and lace, made from this plant, together with paper made from the wood, I shall be happy to show to anyone interested in the experiment.

Another substance used by Mr. Plunkett for paper pulp is the common red clover, *Trifolium pratense*, in order to obtain which the clover is taken, either in its green state or when dried into hay, and first submitted to a rippling process, by means of which the leaves and blossoms or seeds are saved as fodder for cattle. The stalks are then submitted to the action of caustic alkali, bleached, and pulped in the usual manner. Paper and cardboard produced from this pulp is also of a firm and excellent quality.

A third material is subjected by the same gentleman to a similar process with a like result. This substance is the hop bine, or twining stems of the *Humulus lupulus*, a material which, in many parts of the country, may be obtained in almost any quantity, and which has been hitherto regarded rather as a nuisance than as a stock to be converted into a valuable article of trade. Instead of being, as heretofore, burnt up for manure, Mr. Plunkett has shown that it may be converted into a useful paper, the dried bine yielding from 70 to 75 per cent. of fibrous matter.

The fourth and last of Mr. Plunkett's papers is made from the leaves of the yellow water-iris (*Iris pseudacorus*), which is not only a very common weed in Ireland, but is also common enough in the marshy parts of England. It yields, when dry, about 60 per cent. of available fibre or half-stuff, and, as far as one can judge from unsized specimens made by hand, will make a paper equal to that produced from either of the other sources.

Hence it will be seen that the Irish patents in each instance offer a material, not to be used in conjunction with rags or other fibre, but independently, as substitutes for those substances. In each case the raw material is either common enough, or, as in the instance of the Lavatera, may be easily cultivated on waste lands in sufficient quantities to supply all our wants; and, beyond this, to furnish us with a fibre for cordage and textile manufactures of a new but valuable kind at home, instead of seeking supplies from Russia and India.[*]

Independently of "substitutes for paper material" at home, and of the premium before alluded to, the reports of the Paris Universal Exhibition contain an interesting account of a paper material now in course of manufacture by a company established at Florence, from the common asphodel (*Asphodelus ramosus*). The roots are first made to undergo a process of distillation, during which alcohol is obtained, and the residuum, together with the other parts of the plant, is converted into card paper, cards and paper, including writing papers of various qualities. The gum which abounds in the asphodel is a highly advantageous ingredient; it gives gloss to cardboard, and prevents writing paper from becoming absorbent. The stoutest cartridge paper which is made from this plant is found to bend without breaking, and is not apt to tear. Corsica, Spain, Algeria, Portugal, all have hastened to follow the example of Tuscany, and to seek to derive advantage from the asphodel, either as yielding alcohol or paper-stuff, or both. If even the enormous tracts which are covered with asphodel should in time be exhausted, the culture of the plant is by no means difficult. The manager of the Grand Duke's domain, at Alberese, offered, a few years ago, 40,000 francs for the extirpation of the asphodel, in a comparatively limited territory, and no person was found to undertake the next-to-impossible task. It is stated, moreover, that the asphodel produces alcohol and paper, at a much cheaper rate than any other material which has yet been tested, and there is good reason to hope that it may yet prove a providential benefit to many sterile and unproductive districts.

From North America, I have just received a series of specimens of what our brethren are doing on the other side of the Atlantic in paper stuffs. This series contains white pulps, made from white pine, yellow pine, white cedar, red cedar, hemlock spruce, white oak, maple, gum, chestnut, ash, bass, sycamore, birch, catalpa, beech, willow, paper mulberry, mulberry bark, black walnut, elm, tulip poplar, hickory, straw, reed, maize, and sunflower. The American straw papers seem to possess tenacity and quality superior to those of British manufacture. To what extent these wood papers are made and used in America, I have as yet received no information, the promised papers and particulars not having come to hand.

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[*] Specimens of these substances were shown at the Society's last Annual Exhibition of Inventions. See Catalogue for 1858, No. 301.—ED. *J. S. A.*

[†] English Botany, or Coloured Figures of British Plants. London, 1803.

[*] The last patented paper material is that of Mr. Haughton, for converting the refuse of flax straw into pulp. The process consists of an application of an alkali, in a heat of nearly 400 deg. Three tons of flax refuse, at from 20s. to 50s. per ton, can, it appears, be converted into one ton of pulp. The rags for the same amount of pulp would weigh one ton and a third, and the lowest price of rags is £15 per ton.

These remarks on new materials for paper are essentially fragmentary; there are many other substitutes, and some not generally known to the public, which have been patented and experimented upon within the past two or three years; but to enter into any particulars concerning them would extend this paper far beyond the limits I have assigned to it.

It would not be an uninteresting or impossible inquiry to ascertain the history and progress of this question of rag substitutes for paper during the past seven years—a subject to which I may return at some future opportunity.

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SUBMARINE NAVIGATION.

An American invention has just been brought to this country, with a view to its being disposed of either to this or any other European government, and which, if it does one-half of what the patentee guarantees can be done with it, will make such a change in the mode of carrying on a naval war as will put steamers out of the question, and render of no avail the tremendous forts of Cronsdadt or Cherbourg. It is nothing less than a submarine boat,* made only for working under water, in form much resembling the shape of a porpoise, but capable of being made large enough to contain 8, 10, or even 15 men if necessary, with a proportionate quantity of explosives. In a kind of specification which has now been laid before this and the French Government, the patentee says he has invented and constructed a submarine boat, weighing about 8 tons, in which he has, with others, sunk in Lake Michigan, and remained under water for four hours, without any air tubes or other communication leading from his boat above the surface of the water, and propelled the boat in and near the bottom of the lake for several miles, at the rate of about three miles an hour. He has, while in his boat and under water, by means of machinery working through its side, sawed off timbers 14 inches square. He can sink his boat from the surface almost instantly, either to a few inches or feet from the surface of the water, or to 100, or more feet, and again rise quickly or very slowly to or near the surface; go forward, back, or sideways, or come up bows first or otherwise, as may be required. He can attach powder torpedos to the outside of his boat on its deck or sides, and proceed under water out to sea, in any weather, to an enemy's ship in sight, fix or anchor the torpedos under the ship's bottom, set in motion clockwork to fire the torpedos, simultaneously or at intervals, and retire, still under water, out of danger from the explosion and out of reach of an enemy's guns. He can also convey powder torpedos inside his boat of 100lb. (or more) weight, and when under an enemy's ship, pass them out of the side of his boat, through his patent hatch, and fasten them to a ship's bottom and fire them as above-named. He can enter an enemy's harbour under water and make surveys, only showing above the surface a sight tube no more than one half-inch in diameter, and retire still under water, and proceed outside to sea and make his report to the commander of a fleet or ship. He can go out to sea, meet a hostile fleet, go under their bottoms, fix torpedos to go off by clockwork, or bore holes in their bottoms and come away unseen. With a large boat he can carry a 12 or a 24 pound (or even larger) gun in the forward end of his boat near the top, so rigged that he can load in 100 feet depth of water, rise near to the surface, sight the horizon for an enemy's ship, and if one is in sight take the course for her and proceed towards her, even within a stone's throw, rise quickly, so near the surface as only to show the muzzle of the gun through the outside porthole valve, aim at the ship near her water line, fire, then instantly sink to reload, and rise at another point to fire again and repeat. If required, with a large boat, he can remain under water with several men with him, and do service at sea off or in the harbour for several days, without landing or showing one inch of his boat above water. If the boat is required for pearl fishing he can work all day on a pearl bed, raking up and taking in pearls and suffering no inconvenience from impure air, and as the boat is provided with light for deep water work, he can move about on the bottom like a fish, and see pearls where a diver would not. If the boat is required to visit wrecks and remove treasures or goods, it is so constructed that he can saw, bore, or make fast chains or ropes to any point of a wreck, and if required, one or more persons can, while under water, go out of the boat through the side-hatches, enter a wreck or do other service, and return inside of the boat again without inconvenience.

THE STEAM NAVY OF FRANCE.

The following letter has been addressed to the editor of the *Times*:—

"Sir,—In the leading article on the navies of England and France, in the *Times* of Saturday last, you gave a very accurate summary of facts respecting the strength of the French steam navy. If you can spare me the required space, I shall be happy to set forth in detail the successive steps by which that navy has attained its formidable proportions. This I am enabled to do by the receipt of information which reached me too late for insertion in my paper on the navy read at the Society of Arts. I shall draw no political inferences from the facts before me, but simply give numbers and dates for the guidance of those who may desire to draw them.

On the 1st of January, 1850, the steam navy of France consisted of 20 frigates and 86 corvettes and despatch vessels. Of the frigates, two were of 650, two of 540, and 16 of 450 horse-power each; of the smaller vessels one only was of more than 320 horse-power, and most of them were of less than 200. There was not a single line-of-battle steam-ship then afloat in any harbour of France, but, during the year, the *Napoleon*, of 900 horse-power, was launched, and the *Montebello*, a sailing ship, was converted into a steamer, with engines of 140 horse-power only. Two smaller vessels, either corvettes or despatch vessels, were likewise launched in 1850. During the year 1851, no ships of the line and no frigates were added to the French navy; four small vessels formed the only increase of that period. In December, 1851, therefore, the number of vessels composing that navy was 114 in all. In 1852, three ships of the line were added—the *Austerlitz*, of 500 horse-power, and the *Charlemagne* and *Jean Bart*, each of 450 horse-power. Beside these, one frigate, of 260 horse-power, and two smaller vessels, each of 400 horse-power, were launched. In 1853, four more ships of the line floated in French ports, each of 650 horse-power—the *Fleurus*, the *Prince Jerome*, the *Duquesne*, and the *Tourville*; and to these were added seven corvettes and despatch-vessels, three of them of 400 horse-power each. The next year, 1854, brought an increase of five line-of-battle ships; one of them, the *Bretagne*, a new ship, of no less than 1,200 nominal horse-power, and the other four each of 650 horse-power, comprising the *Ulm*, the *Navarin*, the *Wagram*, and the *Souverain*. The number of smaller vessels remained stationary during that year. In 1855, the increase in the line-of-battle ships was six, viz., the *Eylau*, the *Redoubtable*, the *Arcole*, and the *Algésiras*, all new ships, with engines of 900 horse-power each, and the *Tislit* and *Breslau*, converted ships, of 500 horse-power each. This year, the most active year of the Russian war, also brought into existence five floating batteries, 28 gunboats, and 14 screw transports. (I would, in passing, correct an error in the article from the *Conversations Lexicon*, respecting the floating-batteries. The writer says:—'The English batteries were complete failures, and could not even be propelled; the French, on the contrary, were excellent, and answered their purpose.' The truth is, the English and French floating batteries were, to the number of four or five—I forget, at the moment, which—built from precisely the same lines, and were in all their main features alike.) In 1856, seven additional line-of-battle ships were floated; of these the *Imperial* and the *Alexandre* were new, and of 900 and 800 horse-power respectively; while the *Louis Quatorze*, the *Tage*, the *Duguay Trouin*, the *Donawerth*, and the *Duguesclin* were converted, and fitted with engines varying in horse-power from 600 to 450. During the same year, 12 frigates, five of them of 800 horse-power, were added, and the number of corvettes and despatch vessels was reduced by ten. The number of floating batteries and gun-boats remained the same as in 1855, and has, indeed, continued the same until now. The screw transports were not added to this year. The *Ville de Paris* and the *Turenne*, each of 600 horse-power, and the *St. Louis*, of 450, were the only line-of-battle ships added in 1857. The frigates were increased by four, the corvettes by one, and the transports by six in that year. In 1858, the *Ville de Nantes*, of 900 horse-power, and the *Fontenoy*, of 650, both new ships of the line, with four corvettes and three transports, were launched.

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* In the discussion upon Major Sears' paper on "Submarine Engineering and Exploration," read before the Society in March, 1857, Sir Charles Fox drew attention to an invention of an apparently similar character.—See *Journal*, Vol. V., page 249.

"If the foregoing numbers be brought together, they give these results—viz., that during the last seven years—that is, since the flash of the *coup d'état* prepared the world for the Empire's thunder—the number of French steam-ships of war has been more than doubled (being 114 in January, 1852, and 230 in January, 1859), and the number of steam line-of-battle ships raised from two to 32. To complete the statement of the case it is necessary to add that at the present moment eight ships of the line and 25 frigates and smaller vessels are building in the French dockyards. The line-of-battle ships are the *Intrepide*, the *Ville de Bordeaux*, the *Ville de Lyon*, the *Gloire*, the *Invincible*, and the *Normandie*, 900 horse-power each; and the *Massena*, and *Castiglione*, 800 each. The *Gloire*, the *Invincible*, and the *Normandie* are building on the lines of the *Napoleon* razeed, and are to be sheathed with thick iron plates. The order for the conversion of two other ships of the line, the *Friedland* and the *Bayard*, has been issued, but the works have not yet been commenced.

"From the foregoing facts it appears that since the supreme power of the French nation has been in the hands of Louis Napoleon, the French navy has received an average increase of from four to five steamships of the line annually; and the number of similar ships now on the stocks gives an unmistakeable proof of his intention to exceed that average this year. In your article of Saturday last, you have shown with perfect clearness that, notwithstanding these great strides, we have the strongest steam navy in the world; and I endeavoured in the Society of Arts paper to prove that, with an efficient Channel fleet, we should stand in no peril of invasion. But the steady and enormous increase of the French steam navy in large ships appears to point to something very different from a sudden and unsupported descent upon our coast. Two-deck and three-deck steamships are by no means the most fitting vessels for effecting such an operation. They are intended, as their name implies, for the line of battle, and their production in large numbers by the French Emperor is equivalent to a declaration that if we have to meet his forces at all, it will not be on our coasts or in our harbours alone. He is manifestly preparing to meet us, if need be, or if occasion serve, on the open sea, and to contend there for a mastery of infinitely greater value to him than any mere momentary advantage.

"These are not alarmist notions, but plain matters of fact; and they raise the question,—Is England, with her home interests, her Mediterranean ports and islands, and her wide-spread colonies, to see herself surpassed, or even equalled, in her lines of battle, by a neighbouring Power which has but little save its own seaboard to defend?

"I am, Sir, your obedient servant,
"E. J. REED.

"London, Jan. 10."

Home Correspondence.

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THE SHIPS OF THE ROYAL NAVY.

SIR,—I regret if, from an ambiguity in my letter on Mr. Reed's paper, it can be supposed that I objected to his mode of comparing vessels. I said, "It is extraordinary that men will continue to compare the tonnage of vessels, *as if a proper standard were actually in use*."

Mr. Reed does not so compare them, for he allows the rules are defective. He agrees, then, in my proposition, and I fully agree with his reasons for omitting to discuss the said rules in his paper. I am, &c.,
J. MACGREGOR.

Temple, Jan. 7th, 1859.

RAFT SHIPPING.

SIR,—Many suggestions have, of late, been brought before the public on the construction of gun boats, mortar boats, and floating batteries, with a view to making them invulnerable; and I now beg to add my views on that subject. Why not make the floating body for such special services, up to the line of its load displacement, a solid mass of material, of such specific gravity lighter than water, that it shall not sink, however much it may be perforated by shot? It appears to me that a solid combination might be made of cork shavings, light wood sawdust, rush stems, cotton waste, flocks, hemp, and other light materials, which, by the aid of a solution of gutta percha, or other chemical process, would form a solidifying mass so tough, that it could not be knocked to pieces by shot, and so light that it would be only one-half the specific gravity of water, and, therefore, unsinkable, however perforated by shot, and capable of carrying armament and naval equipment to the extent of nearly one-half the weight of its own displacement in tons. Such vessels, of light draught, accompanying fleets of war as tenders to line-of-battle ships, whence they might be manned and stored as occasion may require, would, I submit, form a useful auxiliary, available for shore service or attacking land batteries, which deep-draught ships of the line cannot approach, and would be sunk if they could.

I may observe that this idea was first broached by me two years since, as being applicable to the construction of vessels for carrying treasure and valuables, as diamonds and gold dust. They might be wrecked ashore, but the treasure would be recoverable. I am, &c.,
CHAS. ATHERTON.

Woolwich Dockyard, January 10th, 1859.

THE LONDON MECHANICS' INSTITUTION AND LORD BROUGHAM.

Sir,—It cannot remain an open question whether Lord Brougham is to be left alone to sustain, as it were, by way of penalty, pecuniary shortcomings due to his first step in behalf of educational institutions, such as that of which the London Mechanics' Institution is the type.

What higher privilege for "Institutions in union with the Society of Arts," than to raise the comparatively small amount of deficiency in the form of voluntary contributions by their members.

If you recognize in this suggestion an appropriate method of testifying to the pioneer of a noble cause (while his career is mercifully prolonged to sustain emulative aspirations), that his spirit will survive and command sympathy for his ends and aims, then please publish this note, and allow me to offer my mite through the Manchester Mechanics' Institution, which I invite to take its share in the collection. It was there, as a humble fellow-labourer of Sir Benjamin Heywood, that I first had the honour to greet the great Lord Brougham.

I am, &c.,
AN EX-DIRECTOR OF THE
MANCHESTER MECHANICS' INSTITUTION.
London, January 10, 1859.

THE PATENT OFFICE LIBRARY.

Sir,—The Council has urged upon the members of ths Society the importance of communicating detailed accounts of new processes in arts, or methods of manufacture, of any modifications by which these may be simplified, or labour saved, and of any novel application of raw materials, whether previously known or not, to useful purposes. It has, moreover, thrown out a hint that it may be quite possible that some of the things set down in a long list of *desiderata* as to be done, may already have been accomplished, but that in such cases the knowledge of them is limited.

Now, with the view, sir, of responding, for my own part, to that laudable appeal, I beg to call the attention of professional men, mechanics, and writers on technical subjects, to the valuable records of human ingenuity abroad, which have most liberally been collected for the last few years at the Public Free Library of the Great Seal Patent Office. From the contents of that library, which increases every day in wealth, though not in space, allow me only to quote at random the following:—

"Description des machines et procédés pour lesquels des brevets d'invention ont été pris en France, 112 volumes, 4to.*

"Comptes rendus de l'Academie des Sciences, 43 vols. 4to.

"Bulletin de la Société d'Encouragement pour l'Industrie Uationale, 56 vols. 4to.

"Dingler's Polytechnisches Journal, 137 vols.

"Jahrbucher des Polytechnischen Instituts in Wien, 20 vol.

"Verhandlungen des Vereins zur Beforderung des Gewerbfleisses in Preussen, 32 vol. 4to.

"Recueil spécial des brevets d'invention en Belgique.

"Descrizione del macchine e procedimenti per cui vennero accordati attestati di Privativa nei Stati Sardi," etc., etc.

I think that on the greater part of the 145 subjects proposed by the council for investigation, a new light might be thrown by a careful perusal of such publications as the above, and progress insured by taking advantage of the very negative results of former attempts in the same line. The secret of modern invention, moreover, lying in the skill of combining or modifying known power or effects, rather than in the creation or discovery of absolutely new principles or elements, the history of inventions is as little to be neglected in industrial pursuits as general history in political affairs.

By adopting that course, intelligent men, with a creative spark in them, may glean much, if not make an abundant harvest, and, as the common saying has it: "Many a little makes a mickle."

I am, &c.,
ALEXANDER TOLHAUSEN.
London, 4th Jan., 1859.

Proceedings of Institutions.

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Macclesfield Useful Knowledge Society.—The twenty-third anniversary of the Society for Diffusing Useful Knowledge was held in the Town-hall, on Monday, the 8th of November last. There was, as usual, a large attendance, including many ladies. In the unavoidable absence of the President, John Brocklehurst, Esq., M.P., the chair was occupied by T. Brodrick, Esq., the Senior Vice-President of the Society. There were also present, Lord Stanley of Alderley, E. C. Egerton, Esq., M.P., Samuel Greg, Esq., the Mayor of Macclesfield (F. Jackson, Esq.), the Rev. W. R. B. Arthy, Rev. T. M. Cookesley, Rev. J. Armstrong (Wesleyan Minister), J. May, Esq., W. Bullock, Esq., S. Barton, Esq., W. Potts, Esq., &c.—The Chairman in opening the proceedings, expressed his regret at the unavoidable absence of the President.—The Hon. Secretary then read the twenty-third annual report, for the year 1858, from which it appears that this Society, like every other voluntary institution in the town, has, during the past year of panic and trial, experienced a slight diminution of its income, and consequently has not been as eminently effective as it has hitherto been, and no doubt will be again when trade revives; nevertheless, it has not been inactive. The students, considering the straitened means of many, have praiseworthily clung to it; and in its educational department it can present a goodly array of diligent and persevering pupils. In the recent Examinations of the Society of Arts, five certificates of excellence were granted to four of the pupils by the Council, and one certificate of excellence and two reports of honourable mention have been granted and made by the Examiners at Manchester. The Committee are happy to state that these examinations have infused a spirit of diligence and perseverance into all the classes, which it is hoped will be the means of the pupils gaining more certificates next year. Two lectures have been given during the year, by Samuel Greg and George Melly, Esqrs., the one on "An Hour with the Poets," and the other "An Hour with Charles Dickens," and to both those gentlemen the Committee tender their thanks. Three concerts have been held during the year, which, as usual, have given great satisfaction. No material addition has been made to the library, but the Committee have to thank several of the members for contributions to it. In order to reduce the debt which has been incurred in erecting the new Reading Room, and in the various additions and improvements which have been made to and in the Society's premises, it is intended to hold a fête bazaar in aid of the building fund. C. R. B. Leigh, Esq., of Adlington Hall, has kindly placed his park and gardens at the disposal of the committee for that purpose. The committee urge upon the members the importance of a diligent attendance at the classes, and mention that E. C. Egerton, Esq., M.P., has most kindly continued, and promises to continue, his annual donation of five guineas for prizes for the pupils generally; and that Mr. Swinnerton has also continued his donation of one guinea for a prize to the most deserving pupil in the stenographical class.—Lord Stanley of Alderley, in moving the adoption of the report, said that considering the severe distress which the town had been suffering, it was satisfactory to find that the subscriptions had so nearly met the Society's expenses. It was now nearly twenty-five years since the Institution was established, and he had watched its progress with much attention. There was, however, one point with respect to which he must express his regret—the failure of the system of lectures. He thought these should be made amusing as well as instructive, if they were to attract large audiences. He was also of opinion that the better class of light literature should form a part of the library, as affording a wholesome relaxation. He thought the School of Design in connection with the Institution most valuable, and he had had great satisfaction in seeing the progress which the pupils had made, as shewn by the drawings sent up to London, which were very satisfactory.—The Rev. W. R. B. Arthy seconded the adoption of the report, which was carried. The prizes were then distributed to the respective students, the Chairman, Lord Stanley, and Mr. Egerton, taking part in the presentation, and offering a few words of encouragement and advice to the recipients. Mr. E. C. Egerton, M.P., moved a vote of thanks to the officers of the Society for their valuable and unremitting services during the past year. This was seconded by the Rev. J. A. Armstrong, (Wesleyan Minister). The meeting was afterwards addressed by Mr. Greg, Mr. John May, the Mayor of Macclesfield, Mr. David Chadwick (of Manchester), and other gentlemen, and concluded with a vote of thanks to the chairman.

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* An English index of this work is in the press.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......London Inst., 7. Prof. Huxley, "On Biology."
Medical, 8.
Tues. ......Civil Engineers, 8.
Statistical, 8. Mr. Edwin Chadwick, "On the Statistical Evidence of the Results of Competition for Whole Fields of Service."
Pathological, 8.
Wed. ......Royal Soc. Lit., 4½.
Meteorological, 7.
London Inst., 7. Conversazione.
Society of Arts, 8. Mons. Théophile Silvestre, on "Les Arts, les Artistes, et l'Industrie en Angleterre depuis la dernière moitié du dix-huitième Siècle jusqu'à ce jour."
Geological, 8. I. Mr. H. Rosales, "On the Gold-field of Ballarat." II. Dr. J. Harley, "On a new Species of Cephalaspis from near Ludlow."
Ethnological, 8½.
Thurs. ...Royal Society Club, 6.
Antiquaries, 8.
Linnæan, 8. I. Dr. Carpenter, "On Tomopteris onisciformis." II. Dr. Cobbold, "On some new forms of Entozoa."
Chemical, 8.
Royal, 8½.
Sat. ......Asiatic, 2.
London Inst., 3. Mr. Thomas A. Malone, "On the Metallic Elements, and their Principal Salts and Alloys."
Royal Botanic, 3¾.

PATENT LAW AMENDMENT ACT.

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APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, January* 7, 1859.]

Dated 15*th September*, 1858.

2154. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—The separation of iron and steel from their combination with certain foreign bodies. (A com.)

Dated 9*th November*, 1858.

2506. M. Henry, 84, Fleet-street—Imp. in, and in the manufacture of locks and fastenings, and keys for the same.

Dated 7*th December*, 1858.

2804. J. V. Scarborough, Belfast, Ireland—Imp. in apparatus for the manufacture of boots and shoes.

Dated 9*th December*, 1858.

2830. E. L. Pensuete, Dunkirk, France—Imp. in apparatus for driving or for drawing up piles by steam.

Dated 21*st December*, 1858.

2913. R. McLean Livingston, Alabama, U.S.—An improved self-detaching "safety hook" or coupling.
2915. J. H. Bolton and C. Garforth, Chester—Certain imp. in drying yarns or fabrics, and in the apparatus connected therewith.
2917. W. S. Yates, Leeds—Machinery or apparatus for dragging bristles and drawing air and vegetable fibre.
2919. W. Mainwaring, Brunfield, Herefordshire—Imp. in brakes for common road vehicles.

Dated 22*nd December*, 1858.

2921. R. Mushet, Coleford, Gloucestershire—An imp. or imps. in the manufacture of cast steel.
2923. J. Nicholson, Halifax, and D. Crossley, Brighouse, Yorkshire—Imp. in Jacquard machinery or apparatus employed in weaving.
2925. W. Spence, 50, Chancery-lane—Imp. in granaries or apparatus for preserving grain. (A com.)
2927. E. Green, Wakefield—Imp. in tables.
2929. E. Rassome, Ipswich—Imp. in the manufacture of grinding and rubbing surfaces.
2931. J. J. Welch, 17, Cheapside—Imp. in the manufacture of neckties, scarfs, or cravats.

Dated 23*rd December*, 1858.

2933. J. Ronald, Liverpool—Imp. in, and machinery for, the manufacture of "hard-tapped" and "soft laid" twine, "mill banding" strands for ropes and other purposes, and cordage generally from hemp, flax, cotton, and other like fibrous material.
2935. J. Broom, Glasgow—Imp. in the manufacture of steel.
2937. A. Barclay, Kilmarnock, N.B.—Imp. in obtaining and distributing or applying electricity and magnetism, and in obtaining motive power therefrom.

Dated 24*th December*, 1858.

2939. J. T. P. Newbon and T. Smith, Fenchurch-street, and J. Brown, Follit-street—Imp. in machinery or apparatus for raising and lowering or otherwise moving heavy weights.
2491. J. W. Child, Halifax—Imp. in the manufacture of fabrics adapted to be used for curtains, coverings of furniture, table covers, and such like uses.
2943. L. D. Owen, 192, Tottenham-court-road—Imp. in manufacturing horse shoe nails. (A com.)
2945. D. Edleston, Halifax—Imp. in preparing and finishing textile fabrics, and in the means or apparatus employed therein.
2947. E. Humphrys, Deptford—Imp. in brazing metal tubes in tube plates and other metal surfaces to each other.
2949. J. Little, Glasgow—Imp. in lamps.
2951. R. L. Giandonati, St. Paul's Churchyard—Imp. in ornamenting leather cloth.

Inventions with Complete Specifications Filed.

[*From Gazette, Dec.* 31, 1858.]

2953. M. A. E. Mennons, 39, Rue de l'Echiquier, Paris—An improved composition for the protection of certain metallic surfaces. (A com.)—27th December, 1858.
2957. J. Shaw, Manchester—A new mechanical combination, called an indefinite feed movement.—27th December, 1858.

[*From Gazette, Jan.* 7, 1859.]

26. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Certain imp. in steam generators. (A com.)—3rd January, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Jan.* 7, 1859.]

January 5*th*, 1859.

1508. G. J. Newbery.
1510. T. Woolner.
1515. H. Hughes.
1517. J. Davis and T. Evans.
1518. J. Buchanan.

January 7*th.*

1519. W. A. Smith.
1520. H. C. Schiller.
1524. W. Clissold.
1531. J. Marland and J. Widdall.
1532. H. Gidlow.
1534. P. F. Demoulin and J. Cotelle.
1525. T. T. Chellingworth.
1537. R. Smith.
1541. R. G. C. Fane.
1543. G. Collier.
1546. G. Parsons.
1548. F. Sang & T. W. Rammell.
1549. C. N. Kottula.
1551. J. M. Rowan.
1554. G. H. Wain.
1588. T. Wheeler.
1608. A. P. Price.
1622. H. Smith.
1635. J. C. Hill.
1674. D. Adamson.
1690. J. Scott.
1756. T. Greenhalgh.
1782. J. Henderson.
1809. T. Ingram.
1825. S. F. Cottam.
2000. E. Cocker.
2050. J. L. Chester.
2080. W. Riley.
2350. C. W. Williams and G. Eyton.
2430. C. Vero and J. Everitt.
2449. N. S. Dodge.
2549. D. Auld.
2579. F. A. Gatty.
2581. M. A. Muir and J. McIlwham.

[*From Gazette, January* 11, 1859.]

January 11*th.*

1563. R. A. Brooman.
1567. T. Earnshaw.
1572. J. Edwards and T. Newey.
1573. J. J. Field.
1585. E. Owen.
1591. J. Fowler, junr.
1595. C. P. Aston.
1607. P. Arkell and A. Melhado.
1611. W. A. B. Bennett.
1637. C. Doley, E. Bigland, and T. H. Worrall.
1649. J. W. Giles.
1655. W. L. Thomas.
1739. E. J. M. Cetti.
1775. L. Hall.
1805. J. H. Johnson.
1869. A. V. Newton.
2141. J. Wilson.
2605. J. Oakes.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, Jan.* 7, 1859.]

January 3*rd.*

44. H. Bessomer.
71. J. Ashworth.

January 4*th.*

86. W. Pole and F. W. Kitson.
108. J. Hostage, T. I. B. Hostage, and J. Tatlock.

January 5*th.*

55. R. A. Brooman.

[*From Gazette, January* 11, 1859.]

January 6*th.*

53. S. C. Lister and W. Tongue.

January 8*th.*

77. M. Billing & F. A. Harwood.
116. J. Abraham.
117. J. Hamilton, jun.